Graphing Our Way to the Olympics

Brief Overview:

Students will have the opportunity to skip count, compare, interpret, and classify data about the Olympics. They will interpret data and create bar graphs, line graphs, and pictographs. Students will acquire knowledge and interesting facts on the Olympics.

NCTM Content Standard/National Science Education Standard:

Students will:

- Design investigations to address a question and consider how data-collection methods affect the nature of the data set.
- Collect data using observations, surveys, and experiments; represent data using tables and graphs such as line plots, bar graphs, and line graphs;
- Recognize the differences in representing categorical and numerical data.

Grade/Level:

Grade 3

Duration/Length:

3 days (50 – 60 minute periods)

Student Outcomes:

Students will:

- Create and use pictographs, bar graphs, and line graphs
- Interpret and analyze data in order to create pictographs, bar graphs, and line graphs.

Materials and Resources:

Day 1

- Eyewitness Books, Olympics by Chris Oxlade & David Ballheimer
- Chart paper
- Transparency film and Overhead markers (one for each pair/group)
- Teacher and student resource sheets

Day 2

- Eyewitness Books, Olympics by Chris Oxlade & David Ballheimer
- Theme music from the Olympics CD or tape

- CD/tape player
- Red pens (Class set)
- Teacher and student resource sheets

Day 3

- Masking tape
- Teacher and student resource sheets
- Pens/pencils (Class set)

Development/Procedures:

Lesson 1 – Picture Perfect

Objective: Students will display a set of data using a pictograph.

Vocabulary Terms:

- Pictograph – A pictograph uses a repeat picture in a bar graph form to represent data. The symbols compare quantity of a single variable.
- Data
- Key
- Title
- Interpret
- Symbol
- Skip Count
- Tally/Tally mark – A method of keeping count of data by a series of strokes.
- Tally table – An organized table in which data are recorded by using tally marks.

[Definitions taken from *Exploring Statistics in the Elementary Grades*, Glossary]

Prior Knowledge:

Students should have some prior knowledge from second grade about pictographs.

Preparing for the lesson:

- The "Math Talk" bubble should be posted on the wall prior to class. It must be large enough to contain all of the vocabulary from the whole unit. As class progresses, keep a tally next to each word in the bubble as it is repeated by you and the students through conversation. This responsibility can be given to a student as a job **(Teacher Resource 1).**

Pre-Assessment:

- Students will complete **Student Resource 1** and answer the following questions:
  1. What type of graph is shown below?

2. You did a survey to find out who was happy and who was sad, what pictures could you use to represent these feelings?
3. How could you make a representation of the children in our class who are happy?

- Students should spend about 6-8 minutes on the pre-assessment.

Launch:

- Ask students if they know any athletes from the Olympics.
- Read about the history of the Olympics in the book, Olympics! (Page 8, "What were the Olympics?" Page 10, "The Ancient games" Page 12, "Olympia discovered" Page 14,"The Olympics reborn").
- Make a class list of events completed during the Olympics (on chart paper). Eyewitness Books, Olympics by Chris Oxlade & David Ballheimer (Pages 58 & 59 list names of events).
- Take a class vote on students' favorite events. Record results on chart paper.
- Ask students which three categories on the chart have the most votes.

Teacher Facilitation:

- Place students into pairs and give each pair a transparency and an overhead marker.
- Instruct students to use their class data about the students' favorite events of the Olympics to create a pictograph on the transparency.
- Monitor student progress for 5-6 minutes.
- Pick two pairs to share their transparencies with the class on the overhead.
- Place the vocabulary word, "data," on the "Math Talk" dialogue bubble **(Teacher Resource 1)**.
- Ask students to do a Think-Pair-Share about what they know about data.
- Have students share their answers with the whole class.
- Refer back to the chart and discuss the definition of data.
- Place the vocabulary word, "pictograph," on the "Math Talk" bubble.
- Ask students if we can use a pictograph to show this type of data and explain why.
- Model the steps for making a pictograph on the overhead/chalkboard using the data.
- Ask where the title and key belong on the graph.
- Note each component of a pictograph: title, symbols, labels, and key. Add these words to the "Math Talk" bubble.

Student Application:

- Tell students that they are going to create their own pictograph with partners using the data provided.
- Give prompt for student activity on overhead **(Teacher Resource 2)**.
- Distribute **Student Resource 2** to each student.
- Allow students time to discuss what they will do to complete a pictograph displaying the data on the chart.

- Monitor students and answer any questions students have as they complete this guided activity.
- Ask students to describe the data displayed on the pictographs.

Embedded Assessment:

Distribute **Student Resource 3** for each student to complete independently.

Reteaching/Extension:

- For students who are having difficulties remembering all the parts of the graph, add blanks to the resource sheets where the title, labels, and numbers should go on the graph. They will still be responsible for constructing and creating the graph, but this will help them remember the elements they need to include **(Student Resource).**
- For an extension, students can look through the Olympics book to find data they can use to create a pictograph of their own. They can create a tally table to use for the pictograph. If students are working with a partner, they can use each other's tally table to create a pictograph.

Lesson 2 – Making the Bar

Objective: Students will display a set of data using a bar graph.

Vocabulary Terms:

- Bar graph - A bar graph is a graph of data with parallel bars for comparing information from several categories. Each bar represents a category. The height of the bar represents a numerical count.
- Data
- Title
- Interpret
- Category
- Height
- Length
- Horizontal
- Vertical
- Number increments

[Definitions taken from *Exploring Statistics in the Elementary Grades*, Glossary]

Preparing for the lesson:

- Prior to Lesson 2, make a bar graph using the tally marks in the "Math Talk" bubble from Day 1. Do not give the graph a title or heading. Leave it blank so students can predict what data the graph might display during the preassessment for Lesson 2. Make a transparency for your class based on **your** data. **Teacher Resource 3** is given as an example.

- Place the "Olympic" theme song in a CD/tape player. It will be played during the teacher facilitation component of the lesson.
- Keep adding new vocabulary words to the Math Talk bubble from the lesson and tallying the frequency of the words used in class discussions. This can be done by the teacher or a selected student.

Pre-Assessment/Launch:

- Refer to the Math Talk bubble to briefly review the concepts from Lesson 1.
- Distribute the unfinished bar graph to the class (**Student Resource 5**).
- Tell the students that this graph represents data on something in the classroom.
- Give them 5 minutes to label the graph and complete it.
- Walk around and monitor the class with the preassessment checklist (**Teacher Resource 4**).

Teacher Facilitation/Student Application:

- Ask students to place their finished graphs in the middle of their desks.
- Tell the class that they are going to do a *gallery walk* around the classroom to look at everyone's graph without talking.
- Tell everyone to push their chair in and stand behind their desk.
- When the music starts, they can start walking around the room in a line. When the music stops, they must go back to their assigned seat.
- Start the "Olympic" theme song and let students walk around the room and look at each other's work.
- Stop the music once everyone has seen all of the desks.
- Give red pens to each student, and tell them they can change or add anything to their graph now. They must use the pen if they choose to do this.
- Monitor the class as they work further on their graphs, and have a class discussion about the graphs.
- Questions to ask the students: *"What did you add to your graph?" "What did you take away?" "What did you notice about other students' graphs?" "What type of graph do you think this is called?" "Where did the data in this graph come from?" "What types of data can we use this graph to show?"*
- Possible student responses: *"I noticed that other students had a title on their graph so I added a title to my graph." "I think this is called a bar graph because it uses bars." "I noticed that other students labeled their graphs with numbers on the side." "I think this graph is about the number of crayons in the room." "I think this graph is about how many chairs, desks, and tables we have in the room." "I think the graph is about our vocabulary words from yesterday."*
- On an overhead, display the graph on (**Teacher Resource 3**) and tell the students to describe the data set displayed on the graph.. Ask the students to name the essential components of a bar graph. They should identify the title, the headings/labels for each part, the number increments, and the data for the graph.

- Discuss how the *number increments* on the *vertical* side of the graph are determined. Tell students they need to make a decision based on the data they have for the graph. Decide as a class if the correct increments were chosen for this graph. Ask students: *"If the tally marks increased in the data, what would happen to the graph?"* Students should identify that the numbers and bars will be higher. *"If the tally marks decreased in the data, what would happen to the graph?"* Students should identify that the numbers and bars will be lower.

Embedded Assessment:

- Read page 36, "Getting fit," in the Eyewitness Books, Olympics by Chris Oxlade & David Ballheimer. Talk to students about what types of foods athletes need to eat in order to stay fit and healthy.
- Tell students that they are athletes in training for the Olympics. They need to know what types of food and how much they need to get at the store. With a partner, they will read the data on a typical Olympic athlete's diet for one day (**Student Resource 6**).
- Using the data, they will construct a bar graph to show how much of each food they will need to buy at the store (**Student Resource 7**).
- Explain the rubric for the graph to the class and distribute it to each pair of students (**Student Resource 8**).
- Monitor the students and walk around as they work with their partners to create a bar graph for the data. This activity should only be about 10 – 15 minutes long.
- When students are finished, they will write the grade they think their project should receive from the teacher and explain what the reasons are for their opinion.

Reteaching/Extension:

- For students who are having difficulty remembering all the parts of the graph, add blanks to the resource sheets where the title, labels, and numbers should go on the graph. They will still be responsible for constructing and creating the graph, but this will help them remember what they need to do for the graph (**Student Resource 7**).
- For an extension of the assessment, ask students to calculate how much food they will need for a week to stay on their Olympic diet. Have them make an estimate for how much money they will need to buy a week's worth of food. Give them this week's supermarket flyer to look for the items they will need. Have them create a shopping list for the items they choose, and calculate how much money they will need. Their goal is to see if they predicted the correct amount of money for a week's worth of food.

Lesson 3 - Olympic Line Up

Objective: Students will interpret data in order to construct a line plot.

Vocabulary:

- **Line plot**-a display of data along a number line.

Preparing for the lesson:

Premark a large area outside for students to long jump. Mark several places with masking tape so a number of students may jump at the same time. You need to place tape for a horizontal jump line where students will begin their jumps. Place vertical lines marked in inches so students can measure the distance of each jump (see **Teacher Resource 5** for long jump layout).

Pre-Assessment:

- **Show a transparency of Teacher Resource 6.** and distribute pinch cards made from **Student Resource 9** (have students fold the pinch card paper in half so the words are on both sides).
- Students will use pinch cards to indicate which method would be best to display the data on the transparency. Use pinch cards to determine if students can identify which method is used for a given set of data.
- Recommend Response: A line plot is the most logical way to represent the data given because it shows all of Brian's trial times. A pictograph shows quantities and a bar graph compares data in different categories.

Launch:

- Explain to students the long jump is an Olympic track and field event. Famous athletes like Jesse Owens, Carl Lewis, and Jackie Joyner-Kersee have won gold medals for the United States in this event.
- Inform students as future Olympic athletes they will complete a long jump and record the distance of their jumps in inches. Students will complete a total of five jumps and record each jump on **Student Resource 10.**
- Take students out to pre-marked area outside and explain guidelines.
- Guidelines: **Student Resource 11**
  - Each future Olympic athlete will work with a partner. Athlete A will take a running start to the jump line and jump, propelling themselves forward. An athlete's foot may touch the jump line but cannot go over. If the foot goes over the jump line, the jump does not count and the athlete must repeat the jump. Each athlete is given only two redo jumps.
  - After landing the jump, the athlete will stay in place until their partner, Athlete B can measure where his/her heel has landed. Athlete B will record the distance on **Student Resource10**.
  - Athlete A will complete a total of five jumps before switching places with Athlete B.

Teacher Facilitation/Student Application:

- Each group of athletes/students will come back to the classroom to complete their exploration activity.

- Give each group a transparency and overhead marker. Inform students they will continue to work with their partners to take the data they have recorded outside to construct a line plot on the transparency.
- Walk around and observe each group. Select one or two groups to come to the overhead to share their line plot with the class.
- Ask students:"Do we have a new word to add to our Math Talk chart?" *Yes, we can add line plot.*
- Ask: "What do you know about line plots?" Allow several students to share their answers.
- Post the definition of a line plot on the board. Have a student read it aloud (line plot: a display of data along a number line).
- Ask: "When in real life would you use a line plot?" Sample responses: *A line plot is an easy way to display data. It can be used to monitor the number of hours students watch television, play on the computer, study for test, or track the grades on a spelling test.*
- Post **Teacher Resource 7** (What's Wrong With This?) on the overhead. Ask: "What is wrong with this line plot?" Sample Answers: *Unequal increments, does not include a title or labels, and the symbols are inconsistent.*
- As students give answers, make necessary revisions to the line plot on the overhead.
- Note the following:
  - Find the range of the data
  - Create a number line based on the data; keep equal increments.
  - Include a title and label the increments.
  - Place an X for the number of times each number is represented in your data.
  - Cross out used data to avoid using it more than once.
- Give students **Student Resource 12** to complete with a partner.
- Walk around to monitor student progress.
- If necessary, you may pull a small intervention group of students.
- Review **Student Resource 12** using the overhead. Allow students to come to the overhead to share their work.

Embedded Assessment:

Students will complete a journal entry. Students must explain why they think Steve or Josh will make the team and use information from their line plots to support their answer.

Reteaching/Extension:

- Give written guidelines to students who have difficulty with oral directions.
- Intervention: small group instruction provided for students demonstrating difficulty with creating line plots.
- Extension: students may use classroom computers or reading resources to research data and construct their own line plots.

- Intervention: for assessment-sentence starters or word box can be used for constructed responses.

Summative Assessment:

- Students will complete **Student Resource 13A and** B(2 pages) independently.
- Students will create a line plot and analyze the data in order to complete a BCR (brief constructed response).
- **Teacher Resource 8** is an answer key.

Teacher Resources:

- Eyewitness Books, Olympics by Chris Oxlade & David Ballheimer
- http://www.caaws.ca/olympics/2004/special_stories/diet_aug11.cfm
- www.olympic.org
- http://standards.nctm.org/
- www.mdk12.org
- *Exploring Statistics in the Elementary Grades* by Carolyn Bereska

Authors:

Shanna Warburton
Curtis Bay Elementary School
Baltimore City Public School System

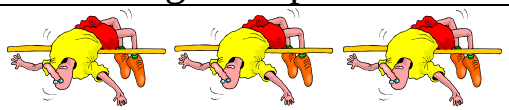
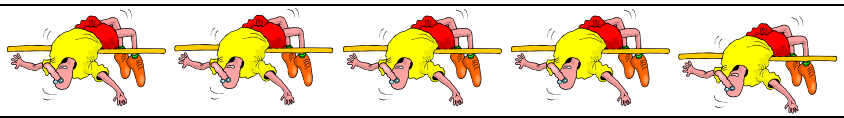
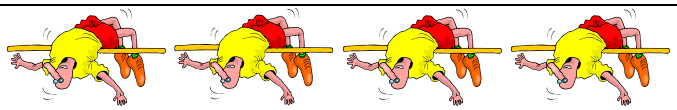
Kelli Hickey
Stoneleigh Elementary School
Baltimore County Public Schools

Student Resource 1

NAME _____ DATE: _____

1. What type of graph is shown below? _____

High Jump Results

Jump 1	
Jump 2	
Jump 3	

Each  = 2 feet

2. You did a survey to find out who was happy and who was sad. What pictures could you use to represent these feelings?

3. How could you make a representation of 7 children in our class who are happy?

Name:_____ **Date:**_____

To prepare for the 2008 Olympic Games, Shanna's coach had her practice her dives.

Shanna's Dives

Which group of data represents this pictograph? Circle the correct letter.

Monday	
Wednesday	
Friday	

Key:  = 3 dives

A.

Monday	9
Wednesday	15
Friday	12

B.

Monday	12
Wednesday	10
Friday	14

C.

Monday	12
Wednesday	13
Friday	14

2. If Shanna dove three more times on Monday, how would that change the pictograph?

_____

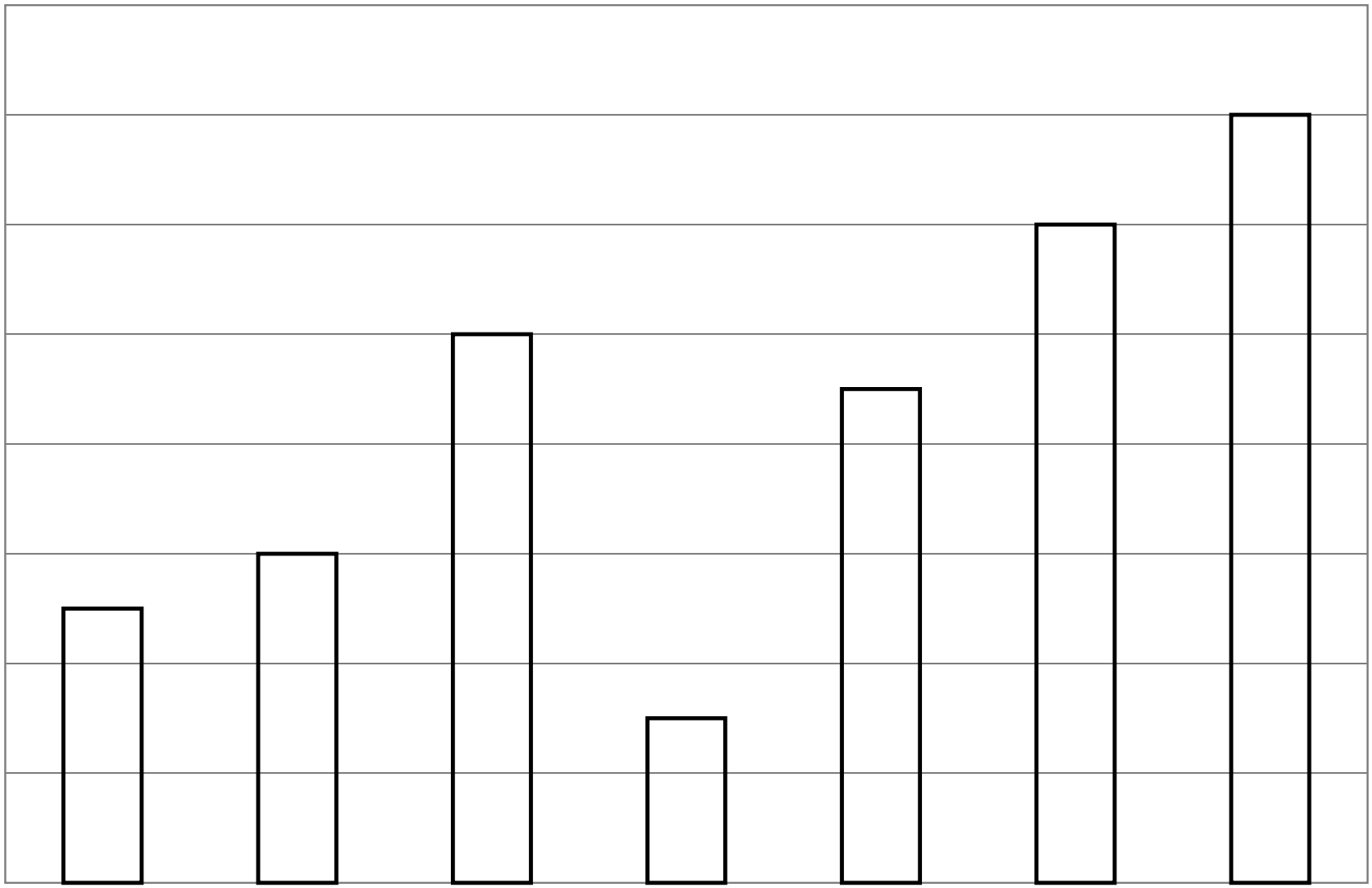
_____

Student Resource 4

_____

_____ = _____

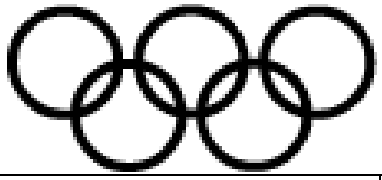
Student Resource 5



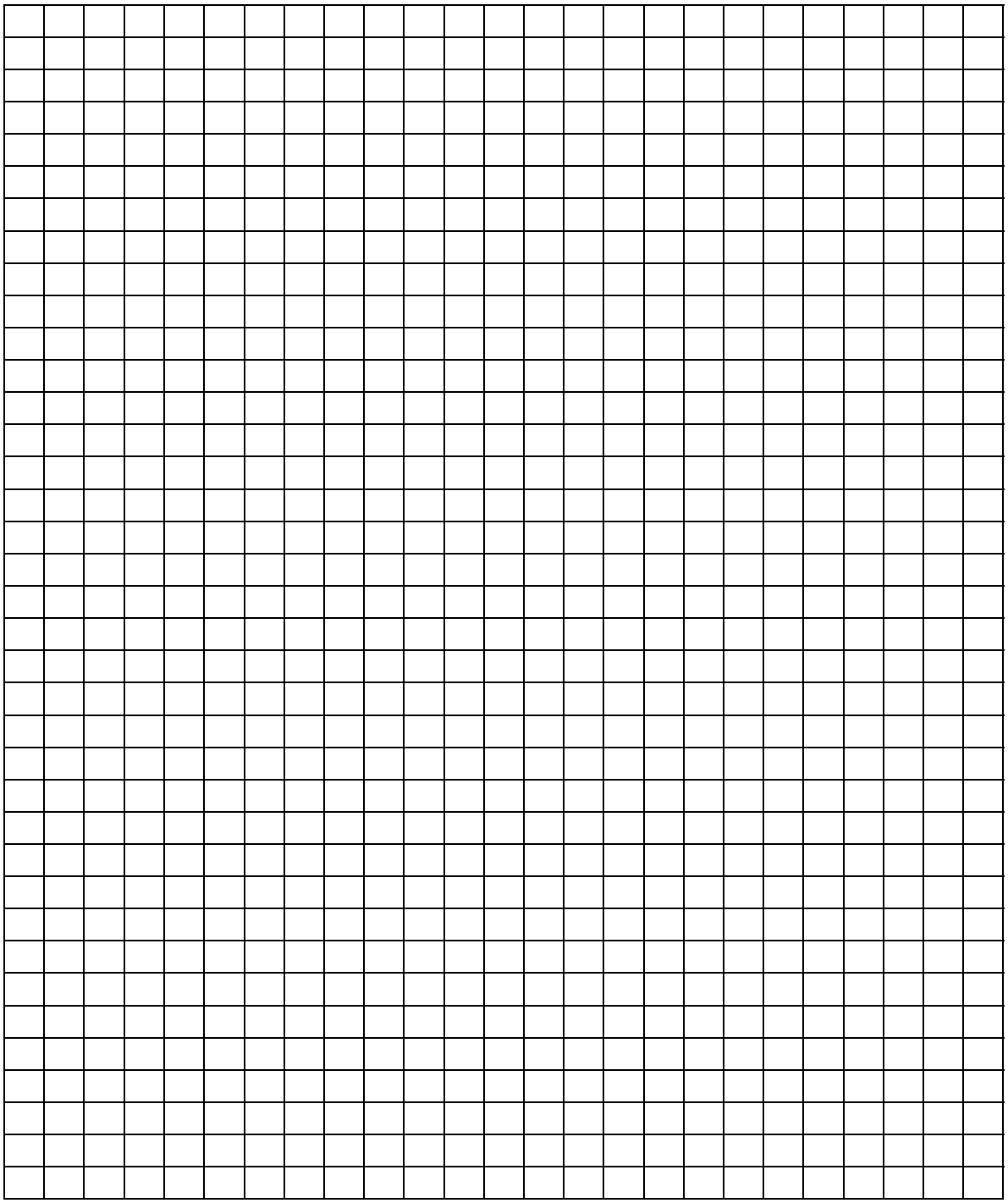
Data

Bar graph

Olympic Athlete's Diet



Meal	Food Item	Amount
Breakfast	**Orange juice**	**8 oz. – one glass**
	Water	**8 oz. – one glass**
	Egg white	**1 whole**
	Whole grain cereal with milk	**5 oz. cereal & 6 oz. semi-skimmed milk**
Snack	**Banana**	**1**
Lunch	**Sports Drink**	**8 oz. – two glasses**
	Salmon	**3 oz.**
	Water	**8 oz. – one glass**
	Soybeans cooked	**6 oz.**
Snack	**Tuna**	**2 oz.**
	Energy bar (eg. PowerBar)	**4 oz.**
Dinner	**Pasta**	**16 oz.**
	Broccoli	**5 oz.**
	Grilled/baked chicken	**3 oz.**
	Black beans	**6 oz.**
	Semi-skimmed milk	**8 oz. – one glass**



Bar Graph Rubric

Name:_____

	Number of points	My Score	Teacher Score	Comments
Included a title	**1**			
Included labels	**1**			
Separated bars	**1**			
Included appropriate number increments	**1**			
Bar graph display matches data	**1**			
Total	**5**			

Student Resource 9
Pinch Card

PICTOGRAPH	PICTOGRAPH
BAR GRAPH	BAR GRAPH
LINE PLOT	LINE PLOT

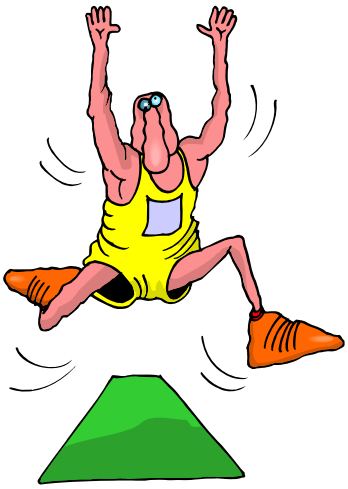
Record Your Jumps!

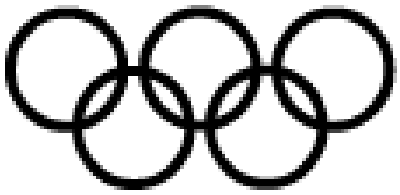
	Jump 1	Jump 2	Jump 3	Jump 4	Jump 5
Athlete A _____ name					
Athlete B _____ name					

- Guidelines:
    - Each future Olympic athlete will work with a partner. Athlete A will take a running start to the jump line and jump, propelling themselves forward. An athlete's foot may touch the jump line but cannot go over. If the foot goes over the jump line, the jump does not count and the athlete must repeat the jump. Each athlete is given only two redo jumps.

    - After landing the jump, the athlete will stay in place until their partner, Athlete B can measure where their heel has landed. Athlete B will record the distance on Student Resource 10.

    - Athlete A will complete a total of five jumps before switching places with Athlete B.





Steve and Josh are trying out for the Olympic javelin team.

Steve – 91, 89, 90, 88, 89, 87, 89, 92, 91, 90,

1. Student A will use the line below to construct a line plot to display the distances Steve threw the javelin.

Josh – 85, 86, 88, 90, 87, 88, 89, 86, 85, 90

2. Student B will use the line below to construct a line plot to display the distances Josh threw the javelin.

---

3. Compare line plots.
4. Decide which boy will make the Olympic javelin team.
5. **Journal Entry**: Who do you think will make the team and explain why. Use information from your line plot to support your answer.

NAME: _____ DATE: _____

Baltimore native Carmelo Anthony is preparing for the 2008 Olympics by practicing his free throw shots. He recorded how many free throws he was able to make in a row. Use Carmelo's data to make a line plot on the line below.

Number or free throws in a row:

5, 10, 12, 6, 5, 10, 8, 10, 3, 4, 10, 8, 12

_____

1. Is Carmelo Anthony a good free throw shooter? Explain why or why not? Use the information from your line plot to support your answer.

_____

_____

_____

_____

Step A:

You have just made a line plot to display Anthony's free throw shots. Using what you know about pictographs, bar graphs, and line plots, decide the best method to display Anthony's data.

_____

Step B:

Explain your answer in step A.
Use what you know about displaying data in your explanation.
Use words, symbols, and/or numbers in your explanation.

_____

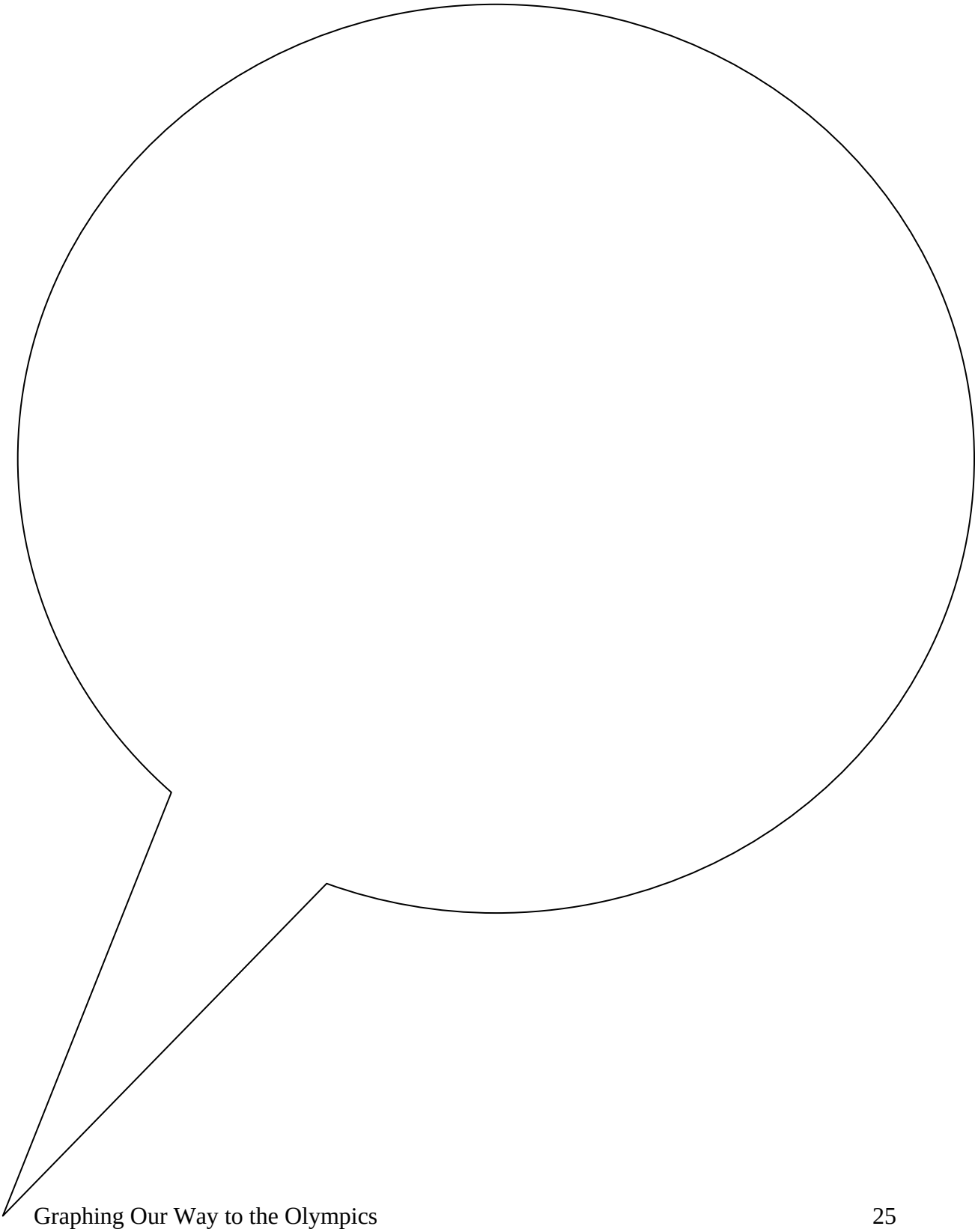
_____

_____

_____

_____

MATH TALK

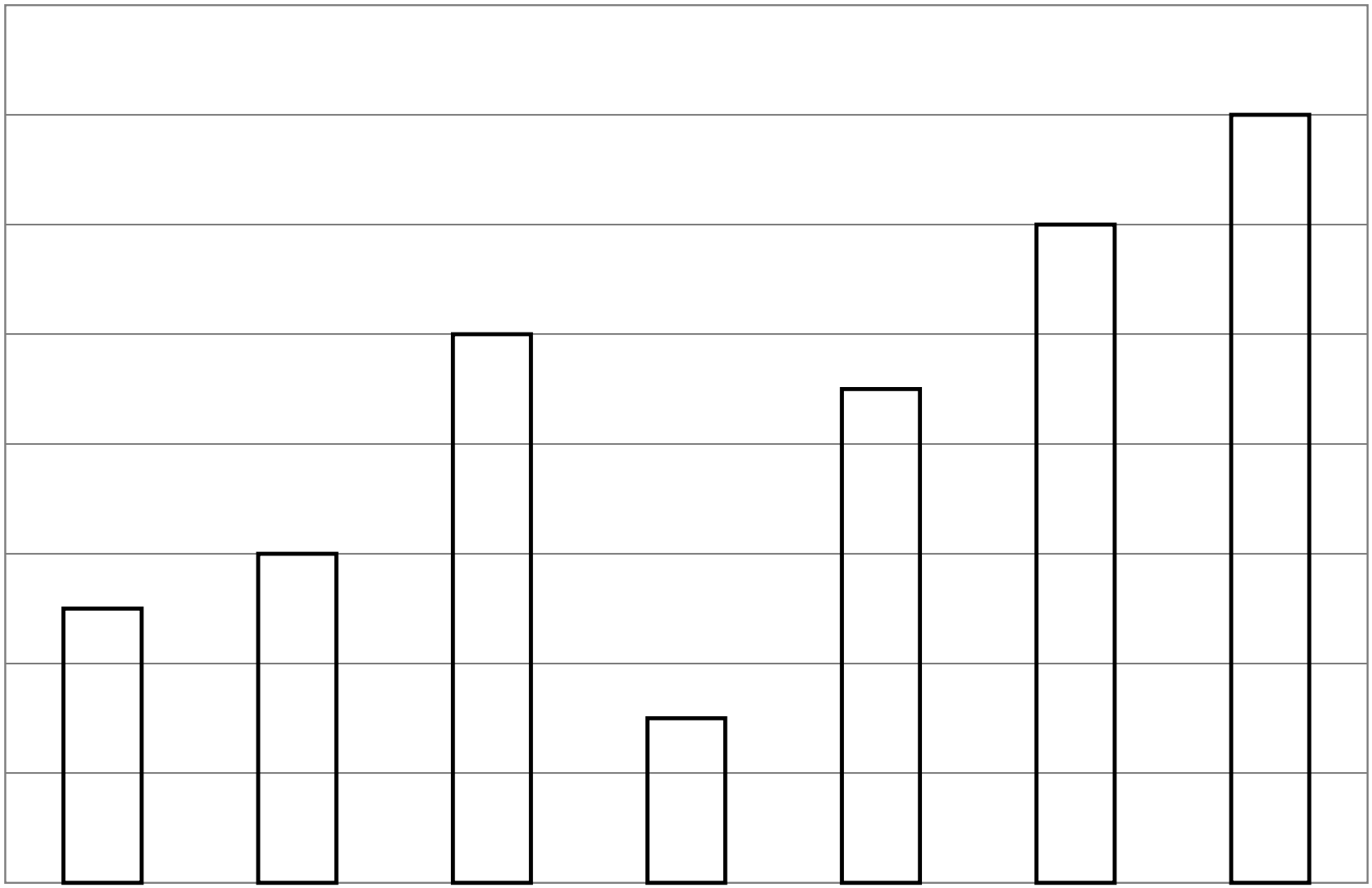


Total Olympic Medals Won

Michael Phelps (swimming)	𝍸 |
Jesse Owens (track and field)	|||
Mia Hamm (soccer)	|||
Wilma Rudolph (track and field)	||||

Example of bar graph

Teacher Resource 3

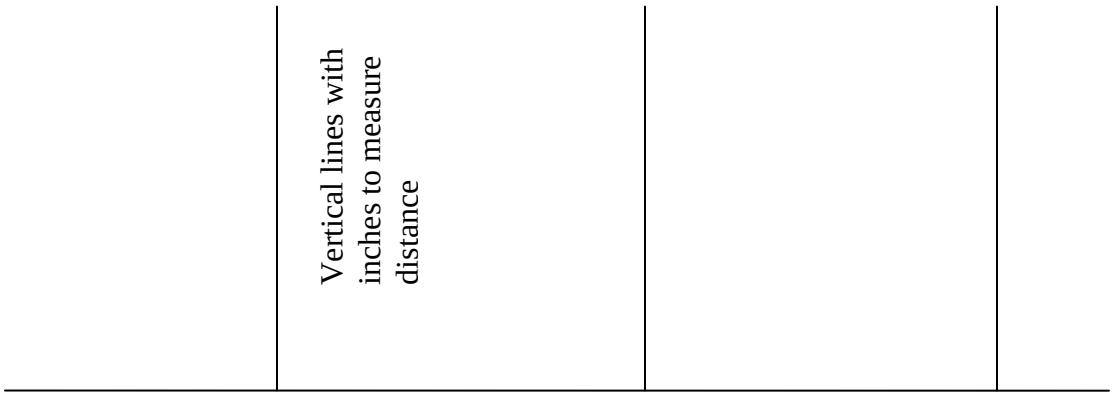


PRE-ASSESSMENT CHECKLIST:

Student Name	**Separated bars**	**Used number increments**	**Used a Title**	**Data matches bar graph display**
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				

KEY:
Check = yes, student included
Blank space = no, student did not include

How to set up the outside jump area



Horizontal Jump Line

Brian is trying out for the Olympic track team. While practicing, Brian ran 100m several times and recorded his times below in seconds.

10, 8, 9, 10, 8, 9, 11, 13, 10, 10, 10

Which is the best method to display Brian's data?

What's Wrong With This?

	X									
	X			X			X			
	X		X	C	C		X	X		
	X		X	X	X		X	X	X	
1	3	4	6	7	8	9	10	11	13	15

Step A:

Think about what you know about pictographs, bar graphs, and line plots. Which is the best method to display Anthony's data?

Line Plot

Step B:

Why is your answer to step A the best method?
Use what you know about displaying data in your explanation.
Use words, symbols, and/or numbers in your explanation.

A line plot is the best method to display Anthony's data because it shows how many times he was able to shoot 5, 10, 6, 12, etc free throws in a row. A pictograph shows how many throws but not how many times he was able to make a number of shoots. A bar graph is best when comparing information.